State of California
AIR RESOURCES BOARD

EXECUTIVE ORDER D-161-22
Relating to Exemptions Under Section 27156
of the Vehicle Code

GALE BANKS ENGINEERING
POWERPACK SYSTEM FOR CLASS "A" 7.4 LITER P-30 MOTORHOMES

Pursuant to the authority vested in the Air Resources Board by Section 27156 of the Vehicle Code; and

Pursuant to the authority vested in the undersigned by Sections 39515 and 39516 of the Health and Safety Code and Executive Order G-45-5;

IT IS ORDERED AND RESOLVED: That the installation of the Powerpack System comprised of exhaust manifolds and pre-cat piping, dual-inlet muffler, air inductor, and governor springs manufactured by Gale Banks Engineering (Banks) of 546 Duggan Avenue, Azusa, CA 91702, has been found not to reduce the effectiveness of the applicable vehicle pollution control system and, therefore, is exempt from the prohibitions of Section 27156 of the Vehicle Code for 1990 and 1992 model-year Class "A" motorhomes with gross vehicle weight (GVW) of 14,000 lbs. or greater powered by a General Motors P-30 7.4 liter (454 CID) gasoline engine.

This Executive Order is valid provided that installation instructions for this Powerpack System will not recommend tuning the vehicle to specifications different from those submitted by Banks.

Changes made to the design or operating conditions of the Powerpack System, as exempt by the Air Resources Board, which adversely affect the performance of a vehicle's pollution control system shall invalidate this Executive Order.

Marketing of this Powerpack System using any identification other than that shown in this Executive Order or marketing of this Powerpack System for an application other than those listed in this Executive Order shall be prohibited unless prior approval is obtained from the Air Resources Board. Exemption of the Powerpack System shall not be construed as exemption to sell, offer for sale, or advertise any component of the kit as an individual device.

This Executive Order does not constitute any opinion as to the effect the use of this Powerpack System may have on any warranty either expressed or implied by the vehicle manufacturer.

THIS EXECUTIVE ORDER DOES NOT CONSTITUTE A CERTIFICATION, ACCREDITATION, APPROVAL, OR ANY OTHER TYPE OF ENDORSEMENT BY THE AIR RESOURCES BOARD OF CLAIMS OF THE APPLICANT CONCERNING ANTI-POLLUTION BENEFITS OR ANY ALLEGED BENEFITS OF GALE BANKS ENGINEERING'S POWERPACK SYSTEM.

No claim of any kind, such as "Approved by the Air Resources Board" may be made with respect to the action taken herein in any advertising or other oral or written communication.

Violation of any of the above conditions shall be grounds for revocation of this order. The order may be revoked only after ten day written notice of intention to revoke the order, in which period the holder of the order may request in writing a hearing to contest the proposed revocation. If a hearing is requested, it shall be held within ten days of receipt of the request and the order may not be revoked until a determination after hearing that grounds for revocation exist.

Executed at El Monte, California, this 7th day of August, 1991.

R. B. Summerfield
Assistant Division Chief
Mobile Source Division

State of California
AIR RESOURCES BOARD

EVALUATION OF GALE BANKS ENGINEERING'S POWERPACK SYSTEM FOR EXEMPTION FROM THE PROHIBITIONS OF VEHICLE CODE SECTION 27156 IN ACCORDANCE WITH SECTION 2222, TITLE 13, OF THE CALIFORNIA CODE OF REGULATIONS

August 1991

State of California
AIR RESOURCES BOARD

EVALUATION OF GALE BANKS ENGINEERING'S POWERPACK SYSTEM FOR EXEMPTION FROM THE PROHIBITIONS OF VEHICLE CODE SECTION 27156 IN ACCORDANCE WITH SECTION 2222, TITLE 13, OF THE CALIFORNIA CODE OF REGULATIONS

by

Mobile Source Division
State of California
Air Resources Board
9528 Telstar Avenue
El Monte, CA 91731

SUMMARY

Gale Banks Engineering (Banks) has applied for an exemption from the prohibitions in Vehicle Code Section 27156 for their add-on Powerpack System designed for 1990 thru 1992 class "A" (GVW of 14,000 lbs. or greater) P-30 motorhomes powered by a 7.4 liter General Motors (GM) gasoline engine.

Banks has submitted a completed application and all the required information as well as bench test data which show that the Powerpack System does not have an adverse effect on the emissions of the applicable heavy-duty vehicles.

The staff recommends that Banks be granted an exemption for their add-on Powerpack System and that Executive Order D-161-22 be issued.

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I. INTRODUCTION

Gale Banks Engineering (Banks) of 546 Duggan Avenue, Azusa, California 91702, has applied for exemption from the prohibitions of Vehicle Code Section 27156 for their add-on Powerpack System designed for 1990 thru 1992 class "A" (GVW of 14,000 lbs. or greater) P-30 motorhomes powered by a 7.4 liter General Motors (GM) gasoline engine.

Banks has submitted a completed application and all the required information as well as bench test data.

II. CONCLUSION

Based on the submitted information and the bench test data performed on a 1990 GM P-30 7.4 liter gasoline-powered motorhome, the staff concludes that the installation of the Banks Powerpack System will not adversely affect the emissions of the 1990 thru 1992 class "A" (GVW of 14,000 lbs. or greater) P-30 motorhomes powered by a 7.4 liter General Motors (GM) gasoline engine.

III. RECOMMENDATIONS

The staff recommends that Banks be granted an exemption for this Powerpack System for use on 1990 thru 1992 class "A" (GVW of 14,000 lbs. or greater) P-30 motorhomes powered by a 7.4 liter General Motors (GM) gasoline engine and that Executive Order D-161-22 be issued.

IV. DESCRIPTION

The Powerpack System is designed for installation on 1990 thru 1992 class "A" (GVW of 14,000 lbs. or greater) P-30 motorhomes powered by a 7.4

liter General Motors (GM) gasoline engine. The purpose of the Banks Powerpack System is to enhance the engine's power and fuel efficiency through the reduction of restrictions in the intake and exhaust system. The Powerpack System consists of exhaust manifolds, pre-catalyst piping, ram air inductor, and governor springs for the transmission.

The exhaust system consists of tubular "header" exhaust manifolds, twin headpipes, dual-inlet low restriction muffler, and a low restriction tail pipe. As with the original equipment manufacturer's (OEM) exhaust system, the main function of the Banks Powerpack System is to route exhaust gases from the two exhaust manifolds of the engine into the muffler prior to the catalytic converter. Each cylinder has a 1.5" diameter tube that combines with the adjacent tubes into a 2.5" diameter tube. On each side of the engine, these two 2.5" tubes feed directly into the muffler where they output as one pipe directly into the catalytic converter. The Powerpack System also includes an air inductor, which uses a flex hose and a boot type funnel located at the grill to naturally induce lower temperature intake air.

The Powerpack system modifies the shift points on the transmission with the use of governor springs. Banks recommends that shift from first to second gear should occur at 32 to 34 miles per hour, which is equivalent to the 3900 to 4100 RPM range, and shift from second into third at 55 to 57 mph, which is equivalent to 4000 to 4100 RPM. Banks supplies color coded governor springs which vary in tension according to color. By changing the tension of the OEM springs, the automatic transmission will lower or raise its shift points resulting in the desired range.

The system operates in conjunction with the OEM computer controlled electronic port fuel injection and emission control system which are already certified with the stock engine. Installation of the Banks Powerpack System does not alter the OEM location of the catalyst or oxygen sensor; however, the oxygen sensor was modified resulting in only sampling the left bank of the exhaust manifold and not both banks as originally equipped, a configuration that is similar to the General Motors C/K trucks with the 7.4 liter port injected gasoline engine. No tune-up specifications have been changed.

V. POWERPACK SYSTEM EVALUATION AND DISCUSSION

The Powerpack System is designed for use on 1990 thru 1992 class "A" (GVW of 14,000 lbs. or greater) P-30 motorhomes powered by a 7.4 liter General Motors (GM) gasoline engine. Because of the GVW rating of the vehicles, emission testing can be performed only on an engine dynamometer. Since Banks sells only a small volume of Powerpack systems applicable to this application (estimated sales around 100 kits per year) and the cost of testing in an engine dynamometer is prohibitive, Banks requested that an exemption be granted based on data from bench testing instead of engine emission testing.

Banks submitted data consisting of exhaust temperature and back pressure at the inlet of the catalytic converter taken during steady state conditions. These steady state readings ranged from 2600 to 4500 RPM which is equivalent to 25 MPH on the low end and 65 MPH on the high end. A 1990 GM P-30 Class "A" 7.4 liter (454 CID) gasoline motorhome with port injection was used for the test. Table 1 and 2 list results of the testing.

Table 1

Exhaust Temperature at Catalyst Inlet

Engine RPM	Temperature Factory Exh.	Temperature Powerpack	Temperature Change	Percent Change
4500	1192	1288	+96	+8.05%
4000	1320	1350	+30	+2.27%
3500	1240	1240	0	0%
3000	1264	1152	-112	-8.86%
2600	1160	1140	-56	-4.83%

Table 2

Exhaust Pressure at Catalyst Inlet

Engine RPM	Factory Exh.	Powerpack	Percent Change
4500	37.5	37.0	-1.3%
4000	37.5	36.5	-2.6%
3500	36.0	35.0	-2.7%
3000	35.0	34.0	-2.8%
2600	33.0	32.5	-1.5%

The device bench test data and the stock bench test data submitted by the applicant varied no greater then 9 percent in the exhaust temperature and no greater then 3 percent in the back pressure. Based on these results, the staff concludes that the installation of the Banks Powerpack will not have an adverse effect on the exhaust emissions of the affected vehicles. The Gale Banks Engineering submitted all the required information and fulfilled the requirements for exemption.

Appendix

GALE BANKS ENGINEERING

BANKS CHEVROLET 454 MOTORHOME POWER PACK

GENERAL INSTALLATION PRACTICES

For ease of installation and trouble-free operation of your BANKS Power Pack, PLEASE READ THIS ENTIRE INSTRUCTION PACKAGE BEFORE STARTING ANY WORK. (This package contains 11 pages of copy, 9 sheets of illustrations, and 2 sheets of parts listing. If any pages are missing from this package, please call GALE BANKS ENGINEERING immediately for a replacement.) Become thoroughly familiar with all components and phases of the installation before starting any work.

Inspect all components supplied for any foreign material that may have entered during shipping and handling.

Most motorhomes will need to be raised 5-6" in front to allow the BANKS exhaust manifolds to be slid into place from under the vehicle. This can be accomplished by driving the vehicle upon several sections of 2x12 lumber nailed together to form a wedge. Fig. 8 shows how these ramps may be constructed if you are doing your own installation.

WARNING: Motorhomes are very heavy. Whatever methods are used to elevate the vehicle must be of sufficient capacity for the vehicle weight involved. NEVER work under any vehicle supported only by a jack of any kind. DO NOT USE concrete blocks or other masonry items that may collapse under the vehicle weight.

Pay particular attention to the routing of any wires. Keep them away from exhaust heat, moving parts and sharp edges that may cause cuts or other damage. Route or tie wires away from critical areas as required. Keep all wires a minimum of 6" from hot exhaust parts, 8" or more is recommended whenever possible.

A general assembly diagram is provided in addition to the specific step or section diagrams in the text (Fig. 1). The general assembly diagram shows relationships of individual components for reference: however, numbered step-by-step procedures should be followed for proper assembly sequence.

Right-hand and left-hand designations refer to the driver's right or left, as seated in the vehicle, (i.e.: Right-hand refers to the passenger side of the vehicle, unless noted otherwise.

The Banks Motorhome Power Pack is designed to fit class A 454 Chevrolet engine/chassis combinations. Because of different equipment layouts used by the various coach builders, some accessories and components may have to be relocated to accommodate the air intake components of the Banks Power Pack.

BANKS 424 MOTORHOME POWER PACK - DUAL AIR PUMP ENGINES

INSTALLATION PROCEDURE

The Banks Power Pack cold air induction components are designed to extend the factory air intake path so that cooler outside air can be picked up from directly behind the vehicle's grille. These components include a molded ram-air inductor, 4" diameter flexible tubing, a molded bulkhead fitting, and installation hardware. Fig. 2 shows a typical hook-up of the air intake components as they tie to the factory system. The ram air inductor also serves as a water separator to drain out any rain water that may enter through the grille.

The Banks Power Pack cold air induction package is intended to fit a number of motorhome body configurations. Because each coachbuilder has a different layout of behind-the-grille components, there can be no one set installation procedure for the Banks air induction package. The following instructions are intended as a guideline for installing the air induction system. Also, some coachbuilders may have installed difficult to relocate components (such as air conditioning freon piping) in the areas where the Banks induction system is normally mounted. In these cases, the installer will have to find an alternate location for the induction components, or omit those pieces that are impossible to mount.

1. Install the foam gasket strip in the groove around the outside edge of the air filter cover ~~casting~~. Peal the paper off the gasket to expose the adheasive. Trim the ends square with a knife or razor blade to form a tight junction. Do not stretch the gasket as you install it.

2. Remove the engine hatch cover from the vehicle. Remove the air filter cover and filter element. Clean any oil or debris from the inside of the air filter base. Install the new air filter element and air filter cover, ~~casting~~. If your original air filter cover has tune up and emissions specifications on it, save it for future reference.

3. Determine a path for the inlet air ducting from the air filter base forward to the vehicle's grille. Some vehicles have a plastic air inlet duct attached to the snorkel on the base of the air filter. This duct typically draws air through a plastic air inlet hood that is mounted either above, or to one side of the radiator. If this duct and hood are in place, proceed to step 4. If not, skip steps 4 thru 8 and proceed to step 9.

4. Disconnect the plastic factory air inlet duct at the air inlet hood. Remove the air inlet hood from the mounting bracket by twisting it until the four tabs line up with the slots in the bracket. See fig. 5.

5. Insert the Banks plastic bulkhead fitting through the bracket from the back side. The bulkhead fitting may be used as is, or the curved portion may be cut off if this lines up better with the factory air inlet duct. Fig. 6. shows where to cut the bulkhead if the curved portion is to be removed.

6. Drill four 3/16" diameter holes through the air inlet hood bracket around the perimeter of the center hole See fig. 7. If the bracket cannot be drilled while in place, it may be unbolted for drilling.

7. Slip the bulkhead fitting into the end of the factory air intake duct, and rotate the bulkhead fitting into the desired mounting position. Have someone hold the bulkhead fitting against the mounting bracket from the back side while you mark the centers of the four drilled hole locations. Drill four 1/16" diameter holes into the bulkhead fitting at these points.

8. Now bolt the bulkhead fitting to the bracket using four No. 6 x 1/2" sheet metal screws. Hook up the factory flex hose from the air filter base to the bulkhead fitting.

9. Determine a location for the ram air inductor. It should be placed as low as possible directly behind the grille, with the the air inlet opening pointing straight ahead. If the grille is at an angle, the ram air inductor should be trimmed at an angle to place the air inlet opening against the back side of the grille with the centerline of the inlet opening horizontal. See fig. 3. Use heavy snips or a hack saw to trim the air inlet opening of the plastic inductor.

The height between the ram air inductor and the air inlet hood should be as great as possible to prevent any rain water not eliminated by the air inductor's water drain hole from climbing up into the air filter. The curved outlet section of the ram air inductor may be trimmed back if less bend is required to make a more streamlined hose routing. See fig. 3.

For motorhomes that do not have the plastic air inlet hood or any air inlet ducting connected to the snorkel on the air filter base, we have provided an additional 3-foot lenghth of a 4" diameter flex hose to run from the air filter base past the radiator. There must be at least a 2 1/4" high clearance between the floor of the coach and the top of the radiator bulkhead panel for the flex hose to pass through. If this clearance does not exist, it may be possible to mount the ram air inductor somewhere else, such as in a wheelwell, etc. It should be located where it will receive the coolest air available, and be shielded from foreign materials such as flying stones and excess water spray.

16. Disconnect and remove the hot air tube from between the air filter base and the right hand exhaust manifold.

17. Remove the exhaust manifolds from the engine.

18. Remove factory starter heat shield.

19. Install the starter heat shield on the starter motor as follows: Loosen the lower stater motor thru-bolt 3-4 turns. Make sure the outer solenoid coil bolt is snug. Place a 5/16" I.D. x 3/4" O.D. flat washer over the stud end of the upper starter motor thru-bolt. Hook the starter heat shield onto the end of the outer solenoid bolt and slide the front of the shield onto the two thru-bolts. The shield goes under the loosened head of the lower bolt and over the washer on the upper bolt. See fig. 9.

20. Tighten the lower starter motor thru bolt against the heat shield. Place a 5/16" I.D. x 3/4" O.D. flat washer and a 1/4-20 nylock nut on the stud end of the upper thru bolt, and tighten. Install a 1/4-20 nylock nut on the exposed end of the outer solenoid coil bolt and tighten. Make sure heat shield will not short against any wiring. See fig.10.

21

~~X~~. Clean exhaust manifold flange surfaces on cylinder heads of any loose rust and carbon. Working from under the vehicle, guide the Banks exhaust manifolds up into place and bolt them to the cylinder heads with the ~~longer~~ original manifold bolts. ~~provided~~.

22 NOTE: Some air conditioner compressor brackets may have to be filed or ground slightly to clear the top of the left hand manifold flange.

23 ~~22~~. Reinstall the hot air tube (E.F.E heat riser) between the air cleaner inlet and the stub connection on the front of the right hand exhaust manifold.

24 ~~23~~. Reinstall spark plugs and tubes. Reattach spark plug wires. Make sure wires are attached to the proper spark plugs. Engine firing order is 1-8-4-3-6-5-7-2, with 1,3,5, and 7 on the left (drivers) side, front to back, and 2,4,6, and 8 on the opposite side, front to back. Make sure plug wire boots are pushed on firmly for good electrical contact, and wires are routed as far away as possible from manifold pipes to prevent heat damage. If the condition of the spark plug wires looks marginal, replace as required.

25 ~~24~~. Open a number 56 hose clamp and thread it through the slots on the oil filter heat shield. See fig. 11. Position the heat shield on the oil filter to provide protection from the closest manifold pipe, then tighten clamp.

26 ~~25~~. Install an exhaust "doughnut" seal in the right exhaust manifold outlet flange. Lightly tap the seal into place with a hammer until it seats.

and left

27 ~~26~~. Install three 3/8" x 2 1/4" studs in the right exhaust manifold outlet flange. Two 3/8 coarse thread nuts jammed against each other on the outer stud threads may be used to wrench the studs into place. Use anti-sieze compound on the threads.

reinstall the catalytic converter, then

28 ~~27~~. Working from the muffler back, install the tail pipe sections most appropriate for your vehicle. Because of various chassis lengths and configurations, your tail pipe hangers may or may not line up properly for the tail pipe routing. We have provided three universal tail pipe hangers that may be attached to crossmembers, frame rails, etc. with the remaining 3/8 - 16 x 1" hex bolts, nuts, and washers. See fig. 1. for tail pipe assembly. Maintain 1 1/2" of clearance to frame and body to prevent rattles and hot spots.

29 ~~28~~. Install the chrome tail pipe extension tip per fig. 1. Extension tip may be slid in or out over tail pipe until desired length is obtained for body width. Then clamp extension to tail pipe using 3" U - clamp.

38 46. Reconnect the battery cables. Start engine and listen for any exhaust leaks. Tighten bolts or clamps to correct leaks as required. When leaks are corrected, lower vehicle. Allow engine to warm up.

39 47. Check the transmission fluid level per instructions in owners manuel, and adjust level as required.

40 48. Test drive vehicle. On a clear section of highway, accelerate at full throttle and note your shift points. In most applications, your 1-2 shift should occur at 32-34 mph. (3900-4100RPM), and the 2-3 shift at 55-57 mph.(4000-4100RPM). If your coach has a tachometer, go by the tachometer reading.

It will probably take several tries to find the right combination of governor springs to achieve these shift points. Remember, lighter springs will raise the shift points, while heavier springs will lower them. Keep track of your testing changes.

Fig. 1

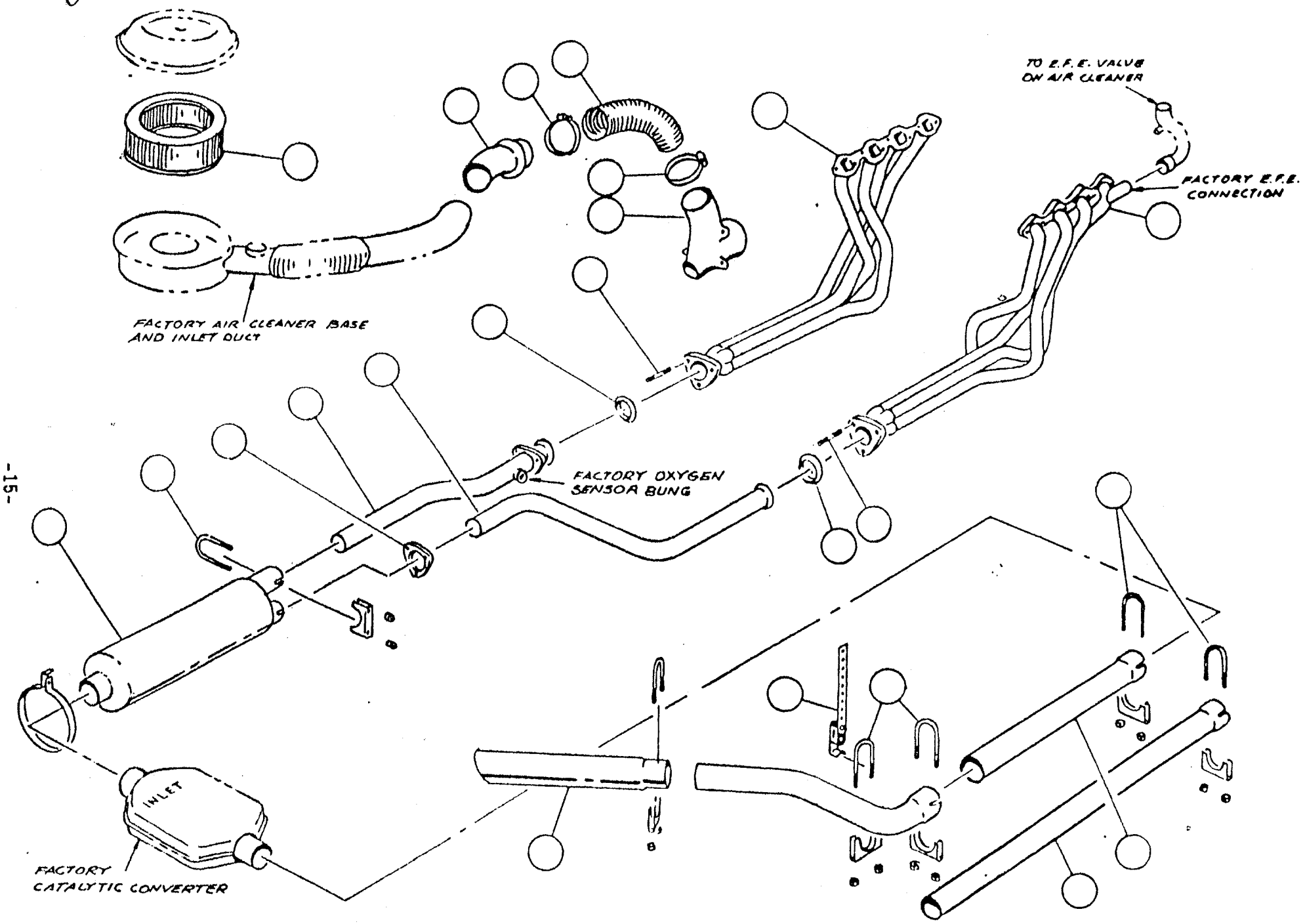

TO E.F.E. VALVE ON AIR CLEANER
FACTORY E.F.E. CONNECTION
FACTORY AIR CLEANER BASE AND INLET DUCT
FACTORY OXYGEN SENSOR BUNG
INLET
FACTORY CATALYTIC CONVERTER

FIG. 2

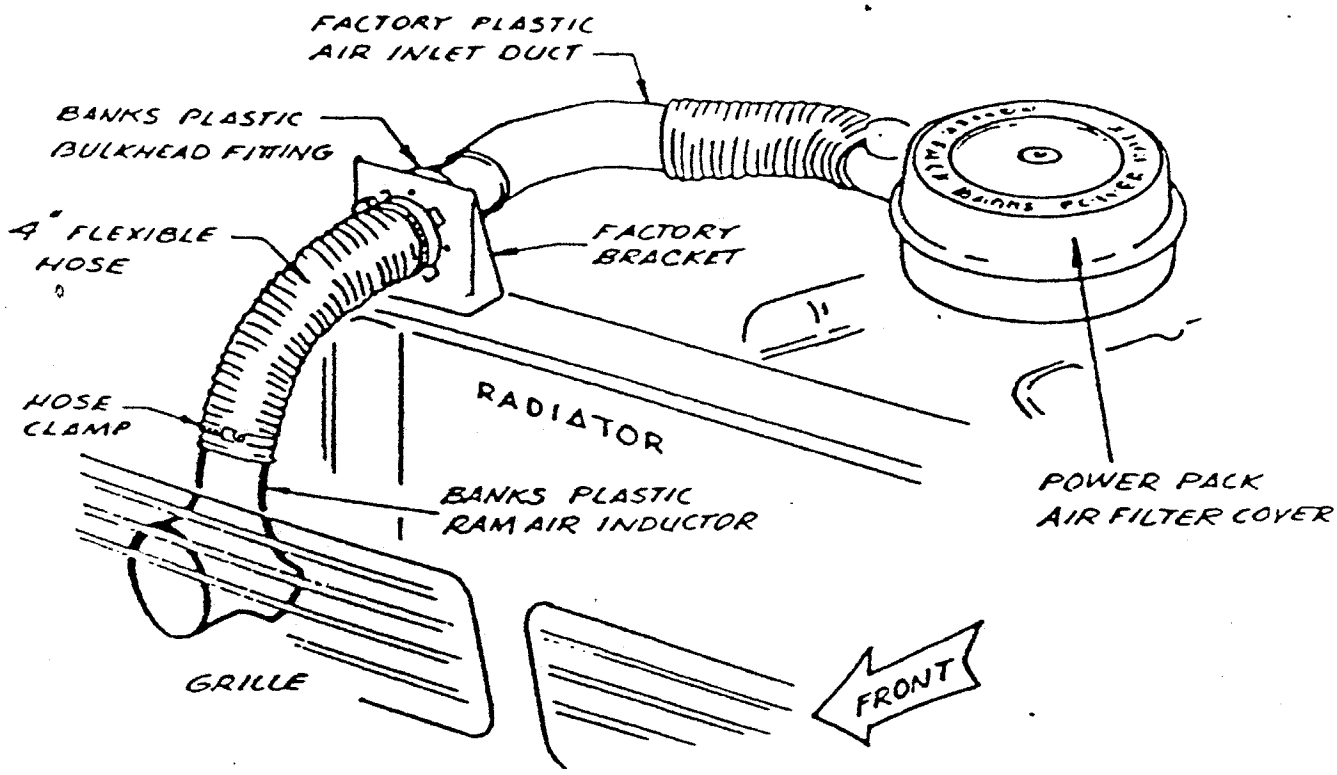

FACTORY PLASTIC AIR INLET DUCT
BANKS PLASTIC BULKHEAD FITTING
4" FLEXIBLE HOSE
FACTORY BRACKET
HOSE CLAMP
RADIATOR
BANKS PLASTIC RAM AIR INDUCTOR
POWER PACK AIR FILTER COVER
GRILLE
FRONT

FIG. 3

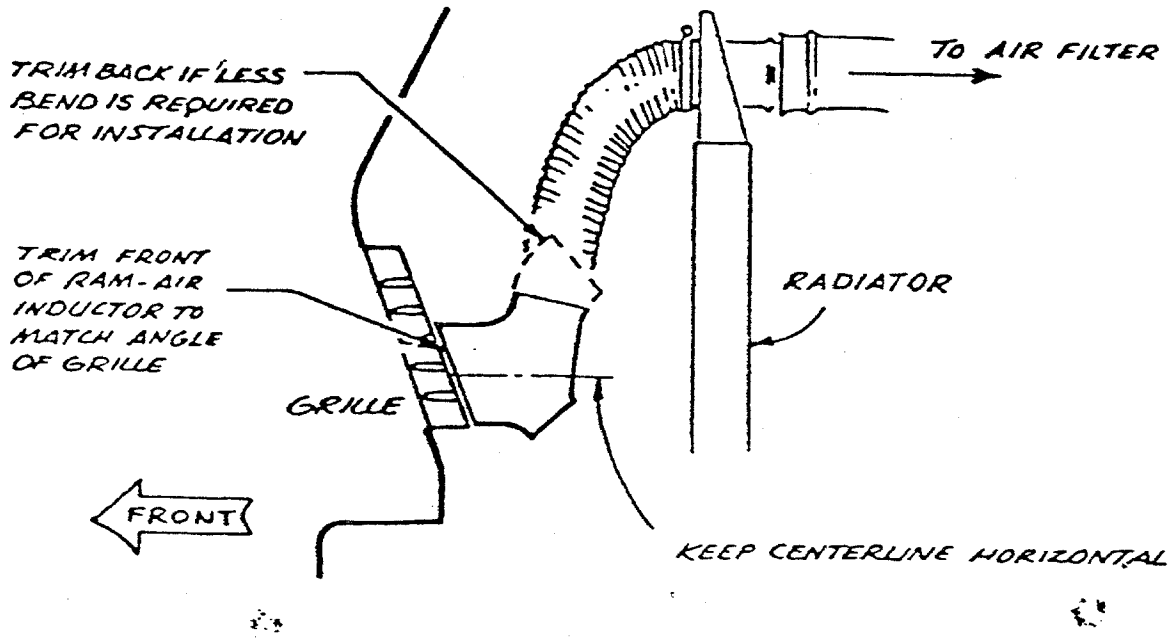
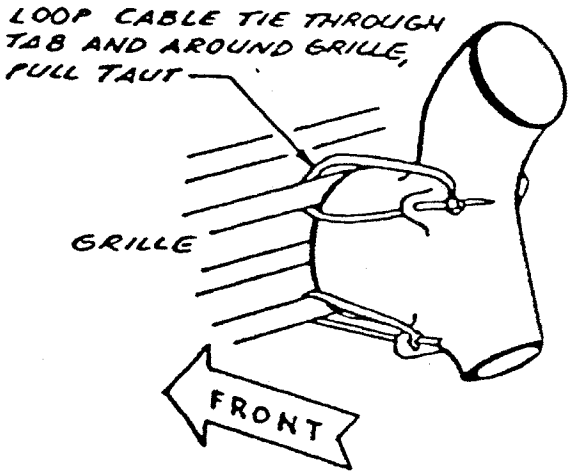

TRIM BACK IF LESS BEND IS REQUIRED FOR INSTALLATION
TO AIR FILTER
TRIM FRONT OF RAM-AIR INDUCTOR TO MATCH ANGLE OF GRILLE
RADIATOR
GRILLE
FRONT
KEEP CENTERLINE HORIZONTAL

FIG. 4

RAM AIR INDUCTOR MOUNTING METHODS

CABLE TIE MOUNTING



STRAP MOUNTING

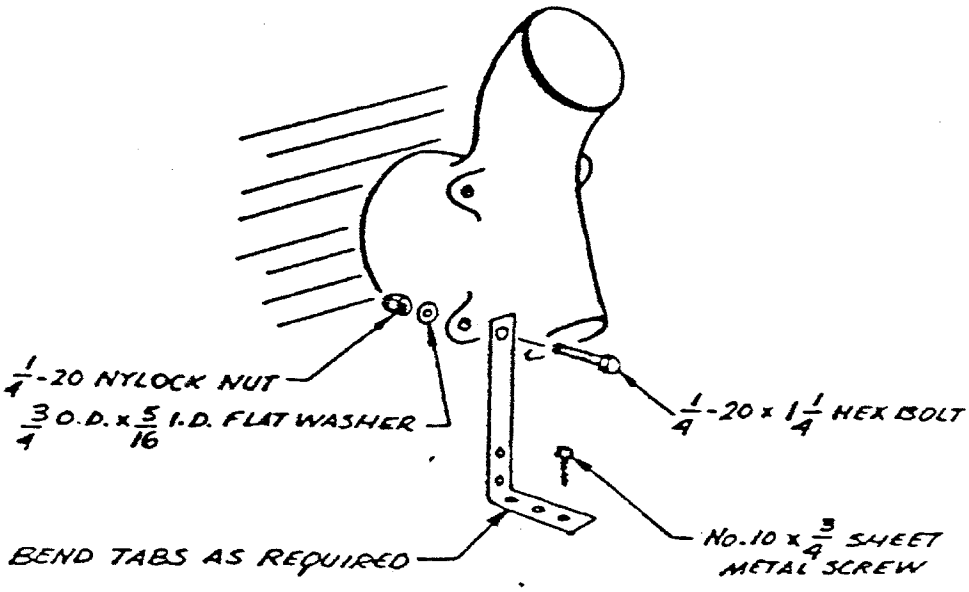


FIG. 5

TO REMOVE PLASTIC AIR INLET HOOD, TWIST HOOD SO TABS LINE UP WITH SLOTS IN BRACKET

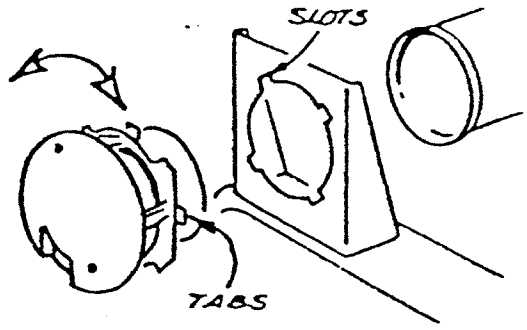


FIG. 6

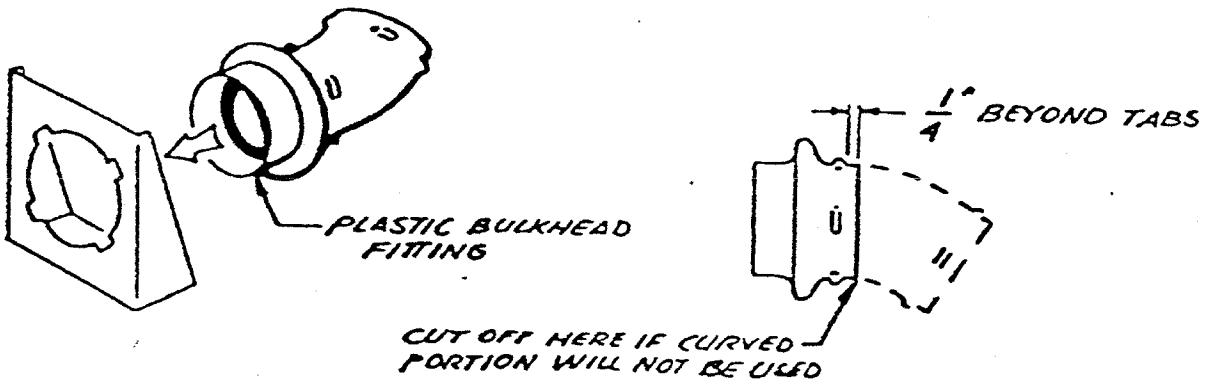


FIG. 7

DRILL 1/4" IN FROM EDGE OF CENTER HOLE 4 PLACES AS SHOWN

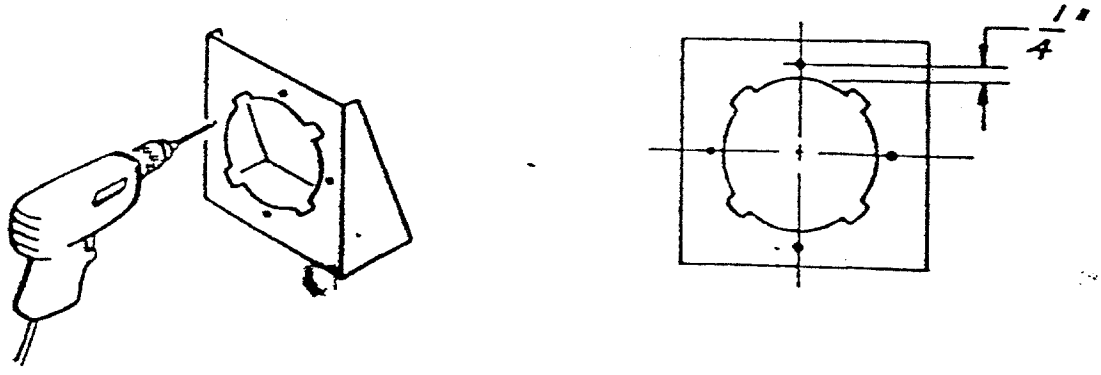


FIG. 9

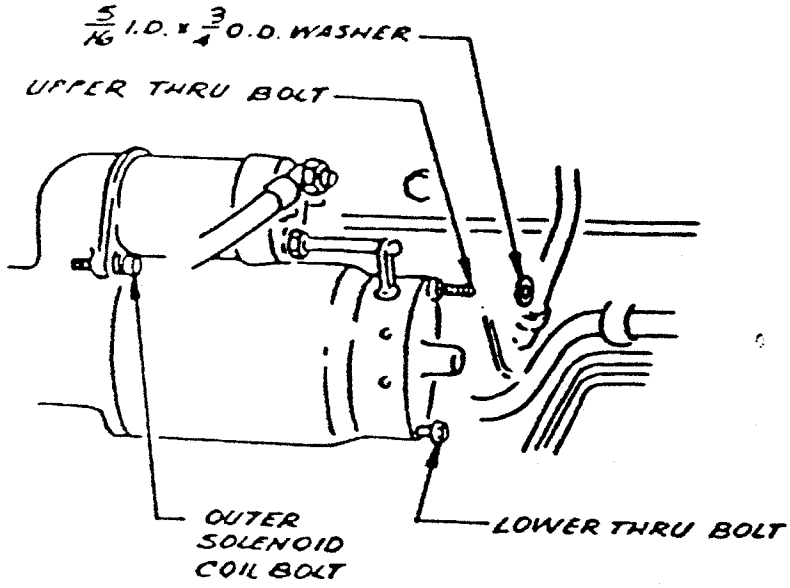


FIG. 10

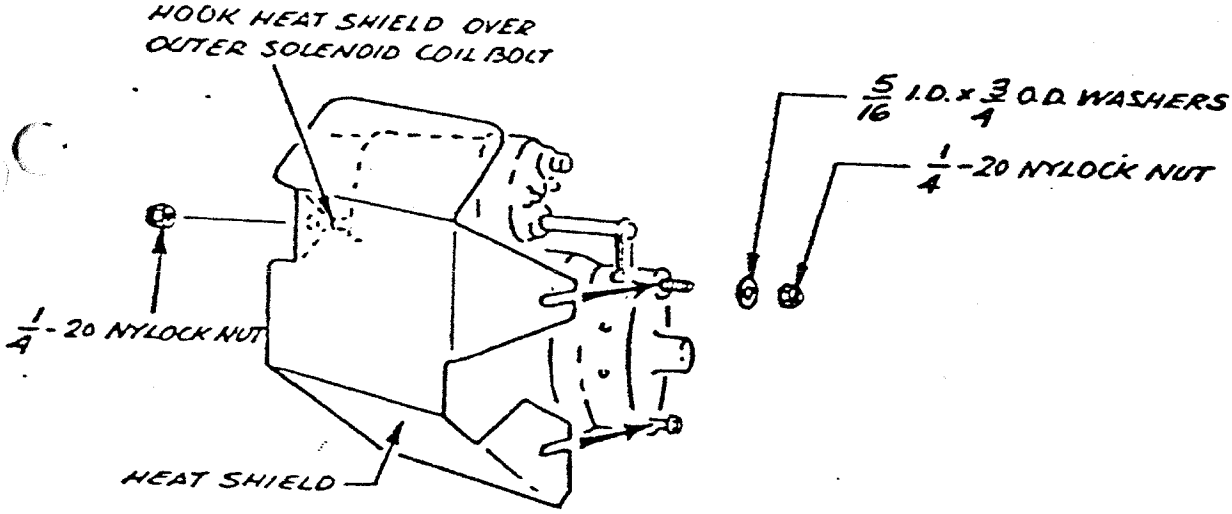
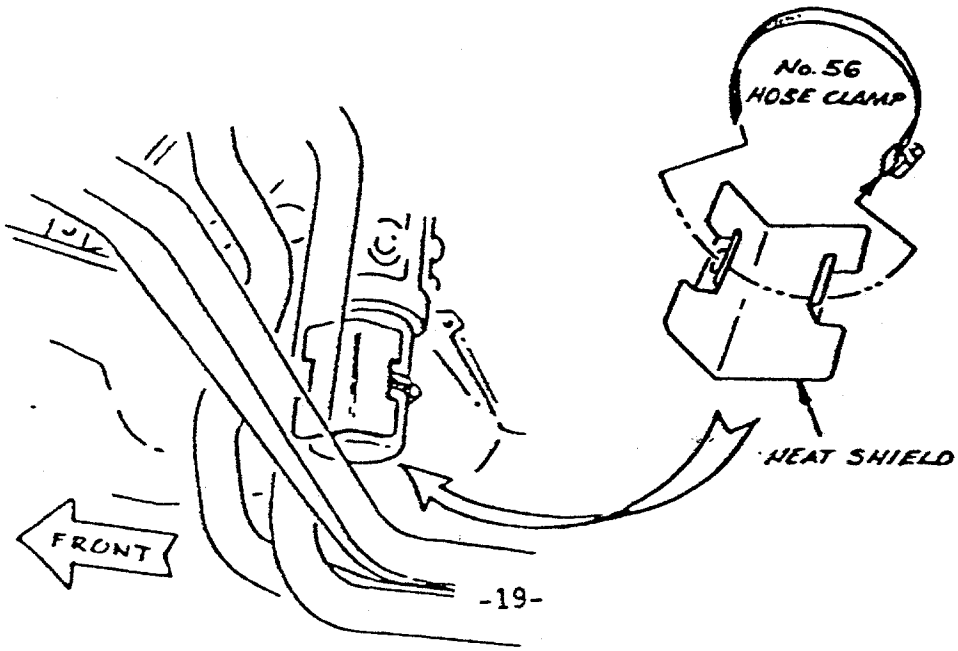


FIG. 11



SYSTEM COMPARISON
FACTORY VS. BANKS POWERPACK
1990-1991 P-30 MOTORHOME